BC hydro and POWEREX

An Overview of Short Term Electricity Trade

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Introduction

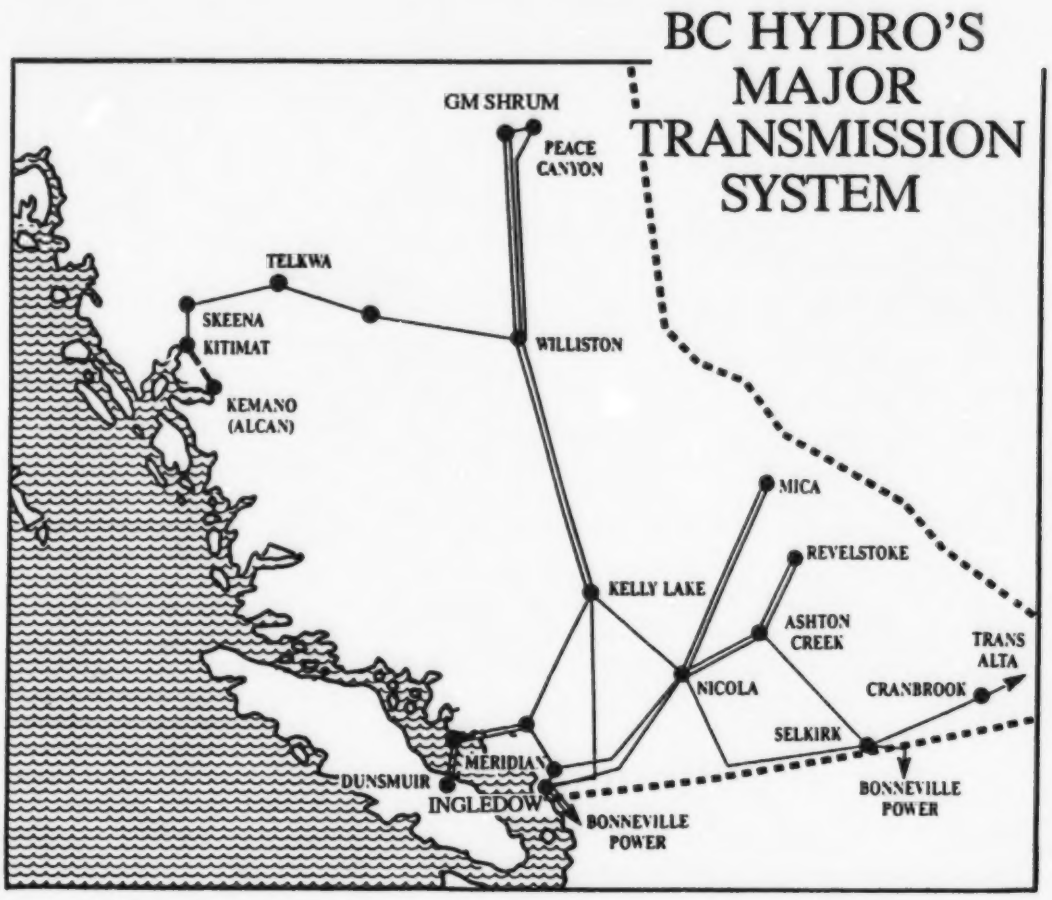
The 1990's present new challenges to British Columbia to meet the growing demand for electricity in the province. To help ensure reliable supplies of electricity are available, B.C. Hydro is looking to new programs such as Power Smart* and Resource Smart*. Other new initiatives such as self generation by industrial users, generation from independent power producers and electricity trade (sale, purchase and coordination) between utilities will also help to ensure an efficient use of resources.

Electricity trade can be defined as the sale, purchase or exchange* of electricity, involving the coordination of resources and operations among interconnected utilities and other electricity suppliers. This takes place because B.C. Hydro operates within an interconnected electricity system which includes Alberta and the western United States (Figure 1). This has allowed additional sales of electricity not needed by domestic customers on a short term* basis, and the exchange of electricity to maximize the use of existing resources. Such arrangements have been made since 1989 by POWEREX, a subsidiary of B.C. Hydro.

For the past 20 years, B.C. Hydro and POWEREX have held certificates and licences for electricity trade on a short term basis with Alberta and the United States. In order to continue these transactions, B.C. Hydro and POWEREX must renew existing provincial and federal authorizations which expire in September 1991. Applications to the Provincial Ministry of Energy, Mines and Petroleum Resources for Energy Removal Certificates (ERCs) and also to the National Energy Board (NEB) for permits will be made in the Spring of 1991. This report provides an overview of the proposed applications. It is part of a public involvement program being undertaken by B.C. Hydro and POWEREX to provide the public with information and opportunities to express their views and ideas about electricity trade.

* See Glossary

Figure 1
B. C. Hydro Interconnected System



Role of B.C. Hydro and POWEREX

B.C. Hydro has traditionally been responsible for obtaining regulatory approvals and managing sales and exchanges of firm* and interruptible* electricity from its system. In 1988, the Provincial government established POWEREX as a wholly owned subsidiary of B.C. Hydro to facilitate development of new generating resources by the private sector for the purpose of long term* sales to United States utilities. POWEREX was assigned responsibility by B.C. Hydro for marketing and coordinating short term electricity trade previously managed by B.C. Hydro, and is working closely with other power producers and suppliers in British Columbia, Alberta and the United States to establish a 'power exchange'. This will help to facilitate the purchase and sale of electricity between producers and customers to make the most efficient use of existing electricity resources, and at rates determined by the marketplace.

B.C. Hydro will continue to be the dominant producer and distributor of electricity in British Columbia. Although B.C. Hydro will not be involved in long term energy sales to the United States from its own generating stations, B.C. Hydro surplus capability will be used to improve system efficiency through short term electricity exchanges and operational coordination with utilities in Alberta and the United States. Also, the B.C. Hydro transmission system will be utilized to access long term markets in the United States. B.C. Hydro will continue to administer several small export sales to Point Roberts, Washington and Hyder, Alaska.

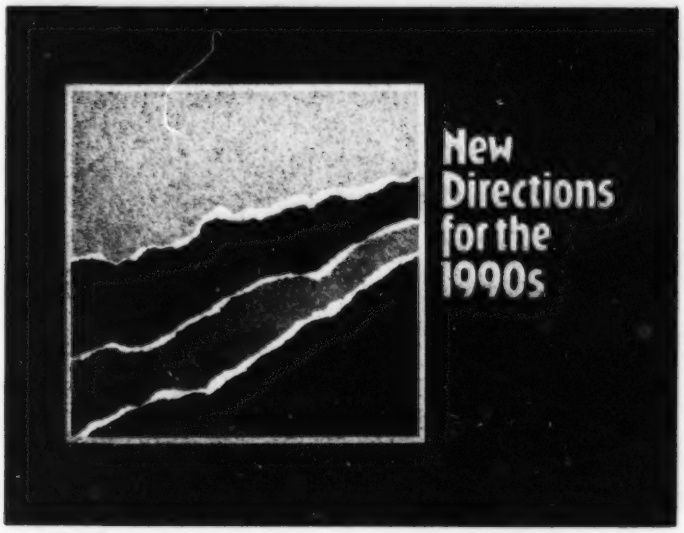
* See Glossary

The Value of Electricity Trade

"Energy resources must continue to be managed to encourage economic growth, employment, regional development, industry and government revenues, and exports."
British Columbia Energy Policy
New Directions For the 1990s, Ministry of Energy, Mines and Petroleum Resources

Over the next decade utilities on the west coast of Canada and the United States will have to develop and implement plans to meet the growing demand for electricity. Although part of these plans may be new generation and transmission facilities, the growing concern about the environment and the need for greater efficiency will require coordination among utilities in planning and utilizing electricity resources. Opportunities exist for utilities in British Columbia, Alberta and the United States to coordinate operations, and to take advantage of seasonal differences in electricity demand and system diversity.

Electricity trade is an important component of British Columbia's recently released energy policy document entitled: New Directions for the 1990s. This outlines policies developed by the Ministry of Energy, Mines and Petroleum Resources for managing energy* resources to meet social, economic and environmental goals for British Columbia.



Copies of the British Columbia's Energy Policy, New Directions for the 1990s are available by contacting:

Communications and Public Affairs Branch
Ministry of Energy, Mines and Petroleum Resources
Parliament Buildings
Victoria, British Columbia V8V 1X4

* See Glossary

The ability to sell and exchange surplus electricity has important benefits for British Columbia:

Security and Reliability

An interconnected system provides a more secure and reliable source of electricity for B.C. residents in the event of a system emergency. In February 1989, purchases of electricity from the United States provided emergency back-up when a transmission line which supplies the Lower Mainland was temporarily out of service. Similarly, B.C. Hydro is able to support neighbouring utilities in the United States or Alberta. The assistance provided to Pacific Gas and Electric in the aftermath of the San Francisco earthquake in 1989 is a recent example.

Coordinating Resources

A coordinated approach to utility management means that systems with different characteristics can coordinate their resources and realize greater benefits or cost savings. An example is the potential coordination between the B.C. Hydro system, which is predominantly hydroelectric, and the Alberta system which has mainly thermal generation resources. Hydroelectric resources have more flexibility in following daily load variations compared to Alberta's thermal resources. A common type of hydro/thermal coordination is "load factoring". The Alberta system can produce inexpensive surplus during off peak hours (at night) but expensive resources are required to meet loads during peak hours. The B.C. Hydro system's ability to follow load variation can be used to store the inexpensive energy during off peak hours for return during peak hours. This increases the operation of Alberta's inexpensive resources, but decreases the operation of their expensive resources. The resulting cost savings are shared by British Columbia and Alberta. Other types of coordination are also possible which would enable deferral of new resources on both the B.C. Hydro and Alberta systems.

"B.C. Hydro is coordinating its power system with those of neighbouring jurisdictions. Pooling of resources in this manner will improve operating efficiencies and allow the deferral of new plant construction."
British Columbia Energy Policy
New Directions For the 1990s,
Ministry of Energy, Mines and Petroleum Resources

Storage agreements are a general form of coordination in which surplus electricity would be stored in the reservoirs of another utility and later returned when the electricity would be more valuable or useable. B.C. Hydro often stores electricity for United States Pacific Northwest utilities which tend to have surplus electricity during May and June when streamflows are high on the Columbia River system.

Coordination and the efficient use of resources can also occur between predominantly hydro-based systems because of different streamflow runoff patterns. When streamflows are high at British Columbia's hydroelectric plants, water surplus to B.C. Hydro needs can be used to generate electricity to support a neighbouring utility which may be in a lower streamflow condition. Similarly, the neighbour utility could also be called on to support B.C. Hydro under low streamflow conditions in British Columbia.

Environmental Advantages

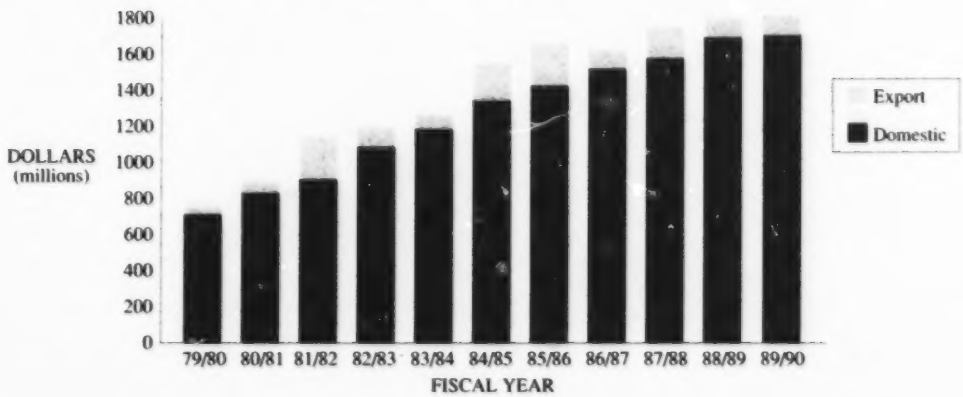
Electricity trade has global environmental advantages. If there were no interconnections with Alberta and the United States, B.C. Hydro's hydroelectric plants would spill water* in exceptionally wet years and Alberta and the United States would use greater amounts of fossil fuel to meet electricity demand. Surplus hydroelectricity available from British Columbia can often be substituted for fossil fuel generation, thereby increasing the life span of fossil resources and minimizing the effects of emissions from these facilities. Coordination of resources is also an important means of deferring development of new generation and transmission facilities on the west coast.

Financial Benefits

There are considerable financial benefits to the economy and people of British Columbia from electricity trade. Average annual gross revenues from electricity trade during the past five years were $150 million (Figure 2), equivalent to 9% of provincial sales tax revenues. These sales have contributed to B.C. Hydro's dividend payment to the provincial government, as a return to the people of British Columbia as shareholders. This helps to support government spending programs for the benefit of all British Columbians.

In addition to revenues from export sales, British Columbia can also realize benefits by importing inexpensive energy from the United States at certain times in order to displace the operation of more expensive resources.

Figure 2
B.C. Hydro and POWEREX Electricity Sales - Revenues



* See Glossary

Background on the Applications

B.C. Hydro and POWEREX will make separate applications to both the federal and provincial governments to allow for the continuation of electricity trade with Alberta and the United States. The applications pertain to all short term transfers of electricity out of British Columbia, including sales to utilities in Alberta and the United States, coordination and storage transactions and emergency backup. Approvals are not required by B.C. Hydro or POWEREX to import electricity into British Columbia from Alberta or the United States.

POWEREX is applying for certificates and permits which allow for short term firm transfers of up to 6,000 Gigawatt hours (GW.h)* per year, and annual interruptible transfers of up to 20,000 GW.h. per year. The POWEREX applications deal mainly with revenue transactions including sales, storage arrangements and some coordination transactions. B.C. Hydro will be applying for a certificate and permit for the transfer of up to 8,000 GW.h of interruptible electricity for coordination transactions and loopflow* transfers.

The following table shows a comparison of the previously approved transfer amounts to the average annual sales that actually occured during that same period, and to the current applications.

Table 1
Exports to the United States

Type of Export	1984 Approved Annual Licence Limits [1] (GWh/year)	Average Annual Energy (1984-90) Transfers (GWh/year)(%)	Proposed New Annual Limits (GWh/year)
Firm Sales	6,000	635 (11%)	6,000- POWEREX
Total Sales and Exchanges	15,000	6250 (42%)	20,000 - POWEREX 8,000 - B.C. Hydro
Loopflow	3,000	697 (23%)	Included in above

[1] **As stipulated in NEB licences.**

* See Glossary

The scope of the proposed applications is influenced by the following considerations:

a) **Net Export Transfers**

Electricity export may be defined as any temporary or permanent removal of electricity from British Columbia. Often, however, electricity which is exported may be returned to British Columbia through coordination and exchange agreements between utilities.

Certificates and permits necessary for export do not account for electricity imports through coordination or direct purchases. Thus, the actual net exports in any given year may be substantially less than gross export amounts reflected in the applications or in reports to the provincial and federal regulatory authorities.

b) **Surplus Electricity**

Electricity surplus to B.C. Hydro's needs occurs primarily because it is difficult for electric utilities to precisely balance their resources due to variations in water levels at hydroelectric plants and fluctuations in electricity demand. Since the B.C. Hydro system is predominantly hydroelectric, this means resources must be planned to meet expected loads even under low streamflow conditions. Because low streamflows occur relatively infrequently, the B.C. Hydro system will tend to have surplus energy most of the time due to additional streamflows into the reservoirs. This surplus electricity is used to reduce more costly generation in British Columbia and to carry out electricity trade.

Surplus electricity also occurs because other electricity producers in B.C. (such as Alcan, West Kootenay Power/Cominco and Independent Power Producers*) and utilities in Alberta have surplus generation at certain times. This electricity may also be made available for electricity trade.

c) **"Enabling" Applications**

Approval of the applications would "enable" B.C. Hydro and POWEREX to continue to sell or exchange electricity not required for domestic purposes without having to make an application to the regulatory authorities for each transaction. The applications do not identify specific contracts or customers.

* See Glossary

The Ministry of Energy, Mines and Petroleum Resources (MEMPR) and the National Energy Board (NEB) have established guidelines to monitor electricity sales to ensure that the needs of B.C. customers have first been met and that the electricity exports are in the public interest.

d) **Building for Electricity Trade**

There are no new generating projects planned as part of these applications for the purpose of short term electricity trade. However, new transmission lines which are planned and designed for domestic purposes may result in temporary surplus capability which can also be used to move electricity to interconnected utilities.

e) **Role of Independent Power Producers**

The Independent Power Producers' (IPPs) initiative encourages the development of electricity resources by the private sector to meet the demand for electricity in British Columbia and to serve the long term firm export markets. There are currently five IPPs which have been identified as possible future sources of electricity for long term trade. If these projects proceed, they will be subject to separate public consultation and project approval processes, and are not part of these applications.

To help supply domestic requirements, there are currently nine IPP purchase agreements with B.C. Hydro which total approximately 235 megawatts* in capacity*. In addition, B.C. Hydro has entered into a coordination agreement with Alcan which will increase firm generation of the combined B.C. Hydro/Alcan system by 60 average megawatts. B.C. Hydro has also entered into an agreement with Alcan to purchase 285 average megawatts of generation for a period of at least 15 years beginning in 1995 for domestic purposes.

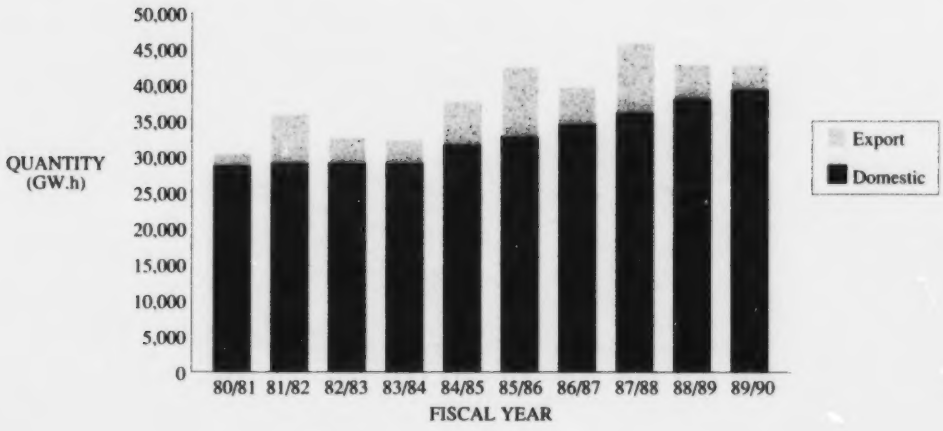
Sources of Electricity for Trade

Electricity in British Columbia comes from a variety of sources including B.C. Hydro's generation system (hydroelectric and thermal plants), Alberta and purchases from independent power producers which are part of B.C. Hydro's integrated system. Electricity available for short term sales or

* See Glossary

exchanges occurs as a result of surplus electricity within B.C. Hydro's integrated system only after the forecasted needs of domestic customers have been met. Figure 3 shows electricity export sales in relation to domestic electricity sales over the past ten years. During this period export sales have ranged from about 8% to 22% of B.C. Hydro's total electricity sales in each year.

Figure 3
B.C. Hydro and POWEREX Electricity Sales - Quantities



In addition to export sales, there are other types of electricity transfers among the B.C. Hydro system and interconnected utilities in the United States and Alberta. These other transfers include electricity purchases and exchanges including storage and coordination transfers. Figure 4(a) shows the historical amounts of total electricity export sales and exchanges with utilities outside British Columbia for each of the past five years. Figure 4(b) shows import purchases and exchanges. The difference between the graphs for each year reflects the net transfer of electricity out of British Columbia.

Figure 4(a)
Electricity Trade with the United States and Alberta

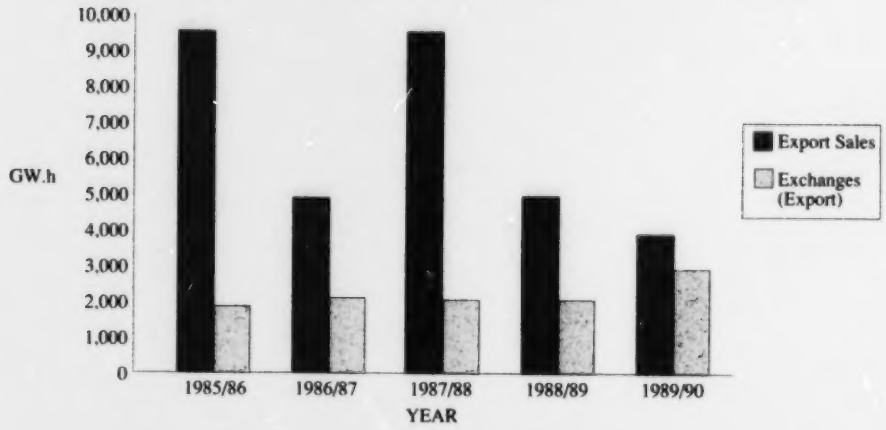
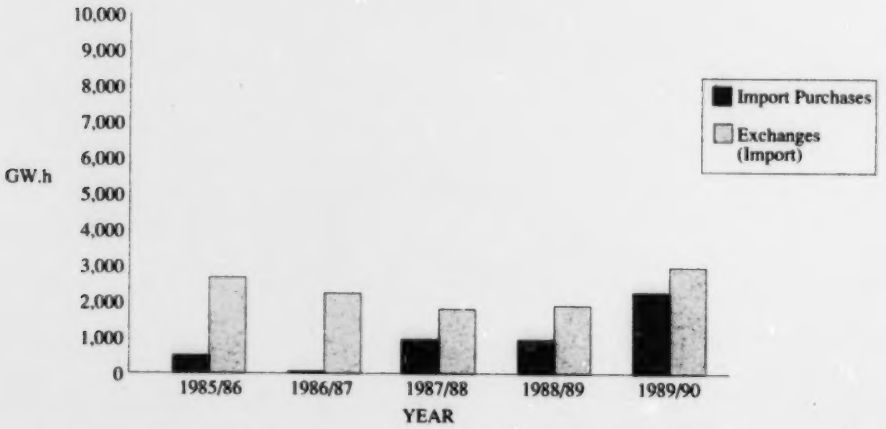


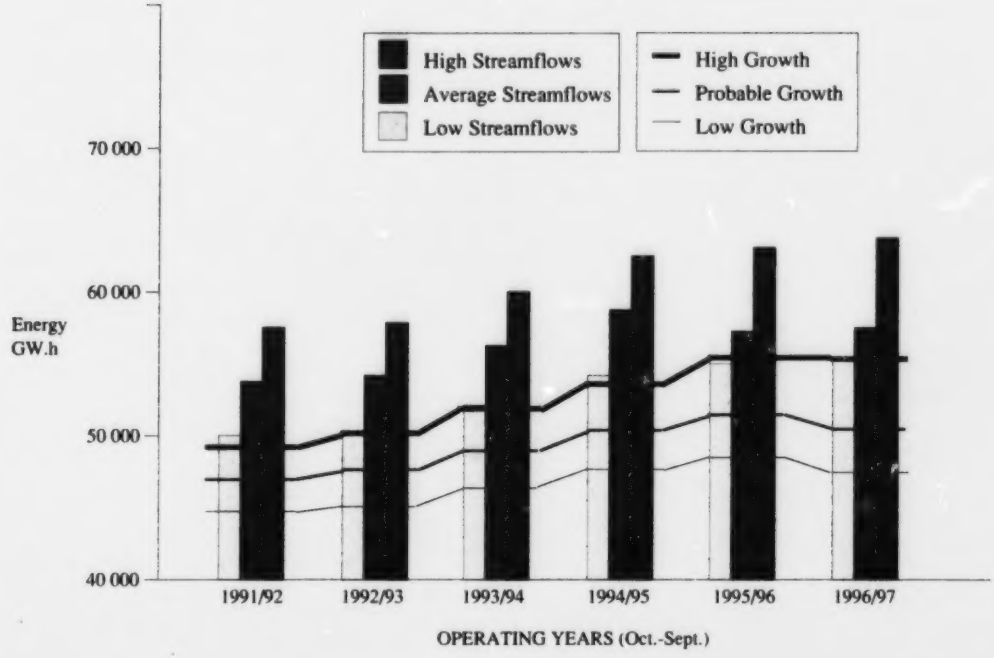
Figure 4(b)
Electricity Trade with the United States and Alberta



The amount of surplus electricity available for trade cannot be predicted precisely because of uncertainties in demand forecasts and resource capability (e.g. hydroelectric output varies with streamflows). Figure 5 shows these demand and resource uncertainties for the B.C. Hydro system for the six year period of the proposed applications. The lines on the Figure show expected system domestic demand under low, probable and high growth assumptions. The bars on the Figure show the variation of resource capability under low, average and high water conditions. The differences between each of the bars and lines in each year represents the range of possible surplus electricity available from the B.C. Hydro system.

In addition to electricity available from the B.C. Hydro system, additional resources could be available through purchases from Alcan and Alberta. These could amount to 2,000 to 3,000 GW.h. per year.

Figure 5
B.C. Hydro System
Net Loads and Available Resources



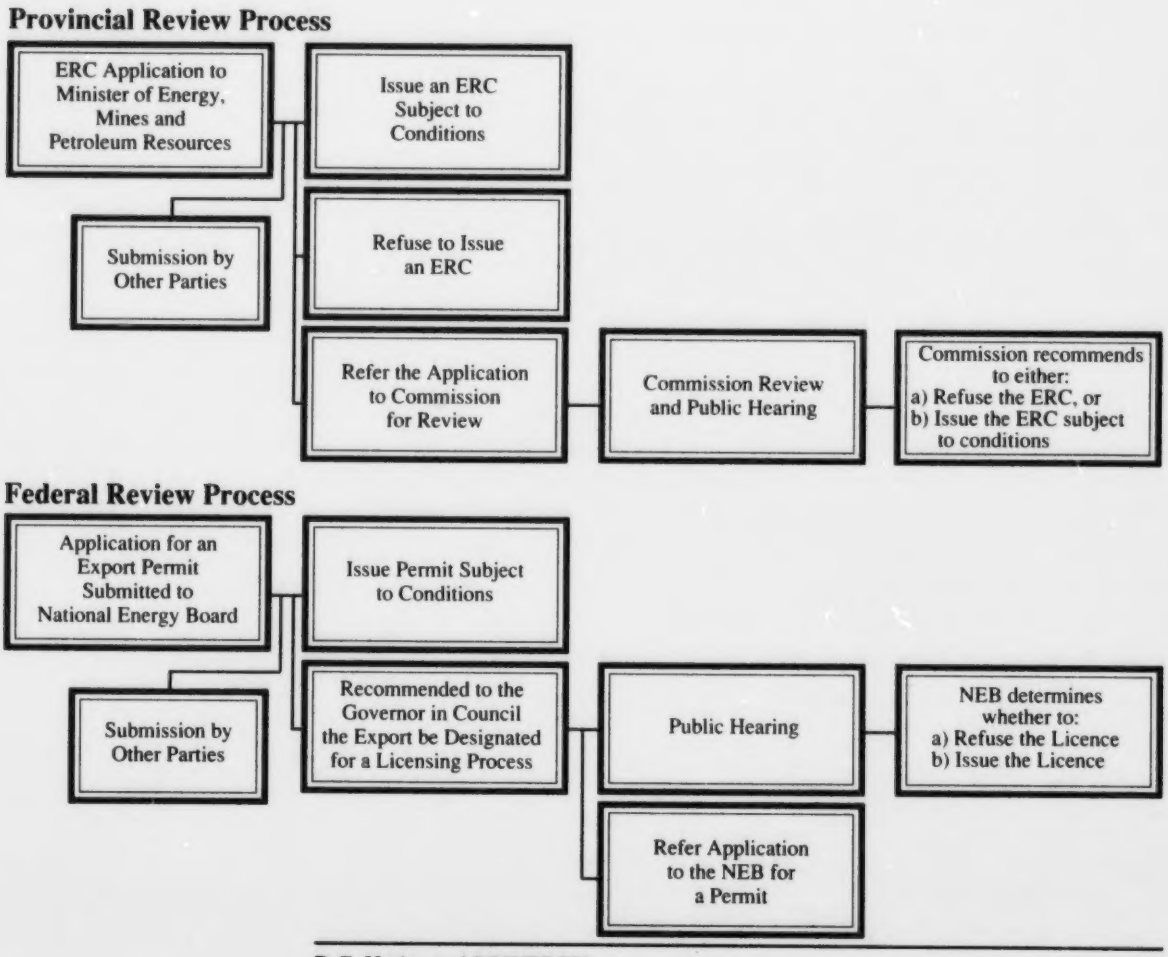
Approvals for Electricity Trade

"The requirements for issuing Energy Removal Certificates will continue to ensure that removals consist only of electricity and natural gas which is not needed in the province."

British Columbia Energy Policy
New Directions For the 1990s.
Ministry of Energy, Mines and Petroleum Resources

The British Columbia Utilities Commission Act and the National Energy Board Act of the government of Canada require application for certificates and permits to allow electricity trade to occur. Provincial Energy Removal Certificates (ERCs), and federal permits held by B.C. Hydro and POWEREX expired in September 1990, but were extended for one year to allow sufficient time for public consultation. Prior to September 1991, B.C. Hydro and POWEREX will apply to MEMPR for separate ERCs. Similar applications will also be made to the NEB for export permits. Figure 6 shows the government review processes which takes place once the applications are submitted to the regulatory authorities.

Figure 6
Electricity Trade Application - Government Review Process


Provincial Review Process
ERC Application to Minister of Energy, Mines and Petroleum Resources
Issue an ERC Subject to Conditions
Submission by Other Parties
Refuse to Issue an ERC
Refer the Application to Commission for Review
Commission Review and Public Hearing
Commission recommends to either:
a) Refuse the ERC, or
b) Issue the ERC subject to conditions
Federal Review Process
Application for an Export Permit Submitted to National Energy Board
Issue Permit Subject to Conditions
Submission by Other Parties
Recommended to the Governor in Council the Export be Designated for a Licensing Process
Public Hearing
NEB determines whether to:
a) Refuse the Licence
b) Issue the Licence
Refer Application to the NEB for a Permit

Environmental Commitments

"The adoption of an environmental resolution by our directors signalled our commitment to developing a new "energy ethic" in order to protect the valuable resource entrusted to us. We are constantly exploring ways to produce electricity with the smallest possible impact on the environment."
Chairman
B.C. Hydro,
B.C. Hydro 1990 Corporate Business Plan

Protecting the environment is an integral part of all B.C. Hydro's activities. In carrying out all aspects of its business, B.C. Hydro's Board of Directors has stated that B.C. Hydro will minimize adverse effects on the natural and social environment and actively pursue opportunities to manage resources for the benefit of future generations.

With this commitment, all projects will continue to be operated according to the conditions and limits set out in regulatory approvals and guidelines. For example, B.C. Hydro will continue to operate all its hydroelectric projects within the conditions and limits of water licences issued by the Provincial government.

The role of Burrard Thermal has been of interest to some members of the public who are concerned about air quality in the Lower Mainland. The primary role of the Burrard Thermal plant is to back up B.C. Hydro's hydroelectric generating resources and transmission system. It also supports electricity trade and assists in coordinating operations with other utilities. B.C. Hydro has worked closely with local and regional governments in the Lower Mainland to address air quality concerns and has succeeded in reducing air emissions to 40% below required standards. Nitrogen oxides now account for less than .01% of total plant emissions. B.C. Hydro's operating standards for Burrard Thermal are higher than the requirements set by the Greater Vancouver Regional District, and it is one of the cleanest thermal power plants in North America.

Thermal plants that generate electricity in Alberta will be operated in accordance with permits issued by the province of Alberta. Monitoring the quality and quantity of emissions and effluent is carried out and reported to Alberta Environment on a regular basis.

The ability to integrate resources on the west coast will reduce the overall thermal plant emissions. This occurs because of the coordination which takes place between the operation of utility systems with different characteristics. Surplus electricity which results from additional streamflows into reservoirs can be used to reduce the operation of thermal resources on the west coast.

Public Involvement

B.C. Hydro and POWEREX are committed to public involvement as a means to improve our planning for electricity trade in British Columbia. The public involvement program is designed to:

1. Obtain input from interested groups and individuals on how to most effectively carry out the public involvement program.

2. Provide information about electricity trade, including the export applications, to the public.

3. Identify public ideas and views related to electricity trade and the applications, and to explore ways of addressing concerns through ongoing consultation.

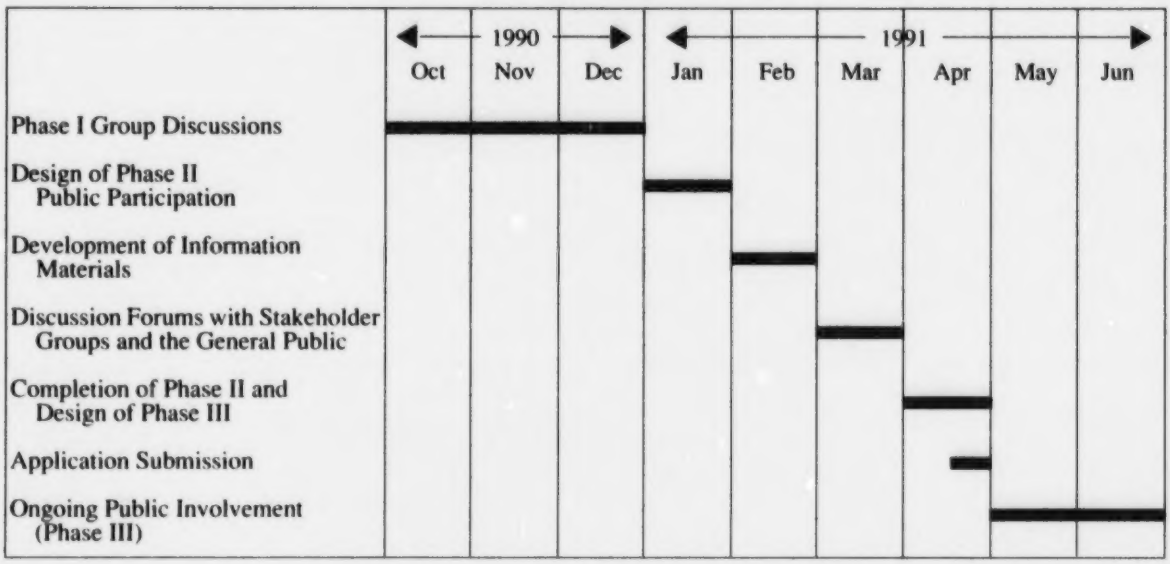
4. Document the public involvement program as part of the ERC and export permit applications.

The questions and issues that may arise as a result of the B.C. Hydro and POWEREX applications are likely to be similar. Hence, a decision was made to undertake a joint program designed to include all matters related to the applications.

The public involvement program is designed to be implemented in three phases. The first Phase involved initial discussions with interest groups to help define future steps in the public involvement program including information needs, possible issues and formats for public consultation. Phase II will take place in March and April, 1991, and provide the public with opportunities to receive information and to express their views and ideas on electricity trade. The public's response will be documented and presented as part of the applications to MEMPR and the NEB.

The chart below shows key steps in the public involvement program over the next few months.

Public Consultation Schedule



As a first step in the public involvement program, B.C. Hydro and POWEREX met with a variety of interest groups representing the environment, small business, consumer interests, energy and the forest industry, to discuss how public involvement should be carried out. Some of the more notable concerns which may pertain to this application that have been expressed include:

Environmental Management

Electricity trade has raised concerns about the need to construct new sources of generation, the use of Burrard Thermal and management of water levels in reservoirs. As previously noted, there are no new generation projects planned as part of these applications for the purposes of electricity trade. Secondly, Burrard Thermal is an integral part of the B.C. Hydro system and is operated regardless of whether electricity is sold or exchanged. With respect to the potential impact of electricity trade on hydroelectric reservoir levels, such transactions may increase or decrease the extent and duration of reservoir drawdown, and water levels may fluctuate more or less frequently. However, all projects will operate within authorized limits set out in water licences.

Electricity for B.C. Customers

A basic premise of the regulatory approvals is that electricity trade not jeopardize the availability of electricity to supply domestic requirements. B.C. Hydro and POWEREX will demonstrate in the applications that the net amount of electricity to be exported from British Columbia would not be required by domestic customers. This demonstration will be on the basis of resource capability under a range of historical streamflow conditions compared with forecast demand. Also, electricity trade will improve the security of supply to customers in British Columbia. Electricity can be purchased from resources in Alberta and the United States to maintain service during emergencies or to displace generation from more costly resources in British Columbia.

Competitive Pricing of Electricity

The actual price of electricity sold to the United States depends on the amount and type of electricity (interruptible or firm), and the time and conditions under which the transactions take place. To monitor the price of electricity which is sold, the Ministry of Energy Mines and Petroleum Resources has established guidelines in the current ERC which state that the price of electricity shall be:

1. Not less than the price for service to a purchaser of electricity within the province on similar terms and conditions.

2. Greater than the incremental operating cost of supplying firm or interruptible electricity.

These guidelines and the importance attached to electricity trade revenues as part of the British Columbia economy ensure that electricity trade will not take place unless there are economic benefits to the province.

Sovereignty and the Free Trade Agreement

The Free Trade Agreement does not obligate B.C. Hydro or POWEREX to enter into contracts to export electricity to the United States, and such contracts will continue to be freely negotiated among utilities in British Columbia, Alberta and the United States. This applies to both interruptible and firm electricity exports.

One possible exception is if a critical shortage of electricity occurred and the government imposed restrictions on electricity sales. Under these conditions, B.C. Hydro and POWEREX would immediately stop any interruptible exports. However, the Free Trade Agreement requires that United States utilities be fairly treated in the following ways:

1. Firm export contracts would continue, but the quantities exported would be reduced in proportion to the reductions to similar Canadian customers. Once the reduced contracts expire, there would be no obligation to renew them.

2. The percentage of the total supply of Canadian energy that had been exported over the most recent 36 month period would be determined, and Canada would have an obligation to provide the United States with access to that percentage of the reduced supply. United States purchasers would, however, have to compete for the electricity with Canadian purchasers.

The Free Trade Agreement provides for the fair treatment of United States customers where firm contracts are in place, and their supply is subject to reduction under critical conditions. Such situations are unlikely to occur because B.C. Hydro and POWEREX are required to demonstrate that the resources for electricity trade are available without risk to domestic customers.

The Free Trade Agreement also provides reciprocal protection for any firm Canadian purchases from the United States. That is, if B.C. Hydro were purchasing firm electricity from a United States utility, the United States could not arbitrarily curtail this purchase because of critical shortages in the United States.

Glossary of Terms

*** Capacity** - is the rate at which electricity can be produced by a generating plant at a given time , measured in megawatts.

*** Energy** - is the amount of electricity produced by a generating plant over a period of time, measured in gigawatt hours.

*** Exchange** - the transfer of electricity between utilities at different time periods to achieve a more efficient overall system operation. Such transfers are possible because of differences in load patterns, generation resource capability, or system operating constraints.

*** Firm Electricity Sale** - the sale of electricity either on a long term or short term basis for which availability of supply is assured.

*** Gigawatt Hours (GW.h)** - a unit of electrical energy. One gigawatt hour is equivalent to 1,000,000,000 watt hours.

*** Independent Power Producer** - A privately owned power generating facility which may be connected to the B.C. Hydro system to supply electricity for domestic or export markets.

*** Interruptible Electricity Sales** - the sale of electricity usually on a short term basis for which the availability of supply is not assured. For example, if B.C. Hydro has insufficient water at hydroelectric facilities, it may cut off interruptible supply.

*** Long Term** - contracts for more than six years. Electricity trade within this timeframe may require construction of new facilities.

*** Loopflow** - the transfer of electricity over one set of interties which is simultaneously imported over another set of interties, due to the tendency of electricity to distribute itself over parallel paths. The B.C. Hydro and BPA systems are in parallel and BPA electricity will "loop" through B.C. Hydro and B.C. Hydro electricity will "loop" through BPA.

*** Megawatt** - a megawatt is a unit of electrical capacity equivalent to a million watts.

*** Power Smart** - A B.C. Hydro program developed to encourage the most efficient use of existing electricity resources, and to reduce future growth in the demand for electricity.

*** Resource Smart** - Engineering improvements to existing power generation and transmission facilities to maximize output.

*** Spilled Water** - water which is spilled at hydroelectric projects without passing through the turbines to generate electricity.

*** Short Term** - contracts for six years or less. Electricity trade within this time frame usually does not require construction of new facilities.

Electricity Trade
Express Your Views

We would like to know your views on electricity trade. Please complete this form and mail it to:

Manager, External Relations
B.C. Hydro
Suite 1610 - 808 Nelson St.
Vancouver, B.C.
V6Z 2H2

OR

Director, Communications
POWEREX
Suite 3450 - 666 Burrard St.
Vancouver, B.C.
V6C 2X8

Name: _____

Address: _____

Phone Number: _____

Comments: _____

_____

_____

_____

_____

or call us toll free at 1-800-663-1377 with your comments. B.C. Hydro and POWEREX would like to hear from you.